A REVISION OF THE GASTROPOD FAUNA OF THE LILYDALE LIMESTONE (EARLY DEVONIAN) OF VICTORIA

By C. B. Tassell

* Present Address Albany Residency Museum, Port Road, Albany, W. A.

Assistant Curator of Fossils, National Museum of Victoria

Abstract

Thirteen species of gatsropods are described from the Lower Devonian Lilydale Limestone near Melbourne. Two of these are type species of the genera *Scalaetrochus* (*S. lindströmi* Etheridge) and *Gyrodoma* (*G. etheridgei* (Creswell)). Another two species *Michelia brazieri* (Etheridge) and in part *Straparollus* (*Euomphalus*) *northi* (Etheridge) are the type species for two now synonymized genera *Vetotuba* and *Liomphalus*. The other species are *Tremanotus pritchardi* Cresswell, *Bellerophon* (*B.*) *cresswell* Etheridge, *Phanerotrema australis* Etheridge, *Stenoloron subaequilatera* (Chapman), *Naticopsis* (*N.*) *lilydalensis* Cresswell, *Murchisonia* (*M.*) *pritchardi* (Etheridge), *Siluriphorus antiquus* (Cresswell), *Loxonema australis* (Chapman), and *Oriostoma rotundimuratus* sp. nov. Also described is *Michelia darwini* (de Koninck) from the Lower Devonian '*Receptaculites*' Limestone, Taemas, New South Wales. The genus *Boiotremus* Horny is considered to be a synonym of *Tremanotus* Hall.

The fauna which lacks platyceratids is associated with a diverse coral and stromatoporoid assemblage and depleted brachiopod fauna. The gastropod fauna possesses strong affinities with the Old World Realm faunas of Europe and North America, and also indicates a continuation into the Lower Devonian of certain typically Silurian forms.

Introduction

The gastropod fauna of the Lilydale Limestone was the subject of much attention by early palaeontologists in Australia. Robert Etheridge, Junr., in a series of papers (1890, 1891, 1894 and 1898) described three new genera, *Gyrodoma, Scalaetrochus* and *Vetotuba,* nine new species and noted the presence of an operculum in place in *Straparollus* (*Euomphalus*) *northi.* At about the same time the Rev. A. W. Cresswell (1885, 1893 and 1894), while noting the general elements of the fauna described four new species and noted the presence of an operculum in place in *S.* (*E.*) *northi.*

Soon after, Chapman (1916) reviewed the entire gastropod fauna. He described one new genus *Liomphalus*, six new species or varieties, and noted the presence of *Omphalotrochus globosum* (Schlotheim). Subsequently the fauna received very little attention. Knight (1941) reviewed the genera established by Etheridge and Chapman; Philip and Talent (1959) discussed *S.* (*E.*) *northi* and *Scalaetrochus lindströmi* and more recently Yochelson and Linsley (1972) discussed the opercula of *S.* (*E.*) *northi* and *Cyclonema lilydalensis.*

The gastropod fauna of the limestones in the Taemas region, N.S.W., has had a similar history of early attention and subsequent neglect. De Koninck (1876) described one new genus, *Mitchellia,* which Knight *et al.* (p. I301, 1960) synonymized with *Scoliostoma*, seven new species and noted the presence of six previously described species.

The basis of this study was the large collection of the National Museum of Victoria which has been collected over a period of more than seventy years. The bulk of this has come from the limestone where it has been the subject of Tertiary weathering (O. P. Singleton pers. comm.). Fortunately the weathering process preferentially destroys the matrix of the limestone before destroying the fossils. Thus at the right stage in this process when the matrix is soft the fossils can be obtained free of matrix and moderately well preserved. The remainder of the collection is preserved in a dense grey limestone.

Middle Palaeozoic gastropods have been the subject of relatively little recent study both in Australia and overseas. As a consequence many of the genera have been interpreted in a very loose sense. So much so, that quite frequently authors note that the species they are discussing, while being assigned to an established genus

in fact belongs to a new genus. In view of this, each of the species from Lilydale has been compared with the type species of the appropriate genus.

However, this has not been done with *Cyclonema anstralis* Etheridge and *C. lilydalensis* Etheridge, the two species of this genus described from Lilydale. It is generally recognized that the Devonian forms assigned to the genus *Cyclonema* in fact constitute at least one new genus (Thompson, 1970). To date no one has attempted to erect a new genus for these forms because a satisfactory basis for distinguishing it from *Cyclonema sensu stricto* is not readily apparent. However, the palaeoecological implications arising from the assignment of these species to the genus *Cyclonema* are quite erroneous. Thus the species from Lilydale are not redescribed here, rather it is intended that they should be the subject of another study. Also not described are members of the classes Monoplacophora, Polyplacophora, Pelecypoda, and Rostroconchia known to occur at Lilydale. These are to be the subject of another paper.

The generic ranges and distributions given by Knight *et al.* (1960) for the genera discussed here are accepted in general. Any amendment of this is based upon a *sensu-stricto* interpretation of the genus.

In this study the following abbreviations have been used: P: Palaeontological collection of the National Museum of Victoria; F.: Australian Museum, Sydney; M.U.G.D.: Melbourne University Geology Department; A.N.U.: Geology Department, Australian National University.

All measurements are in millimetres and the following symbols relating to the measurements have been used:

Clu, spiral sculptural elements above the selenizone.
Cll, spiral sculptural elements below the selenizone.
Hap, height of aperture.
Ht, total height of shell.
L, length measured at the selenizone in bellerophontids.
Lap, length of aperture.
Sw, selenizone width.
Wap, width of aperture.
Wlt, width at last trema.
Wt, total width of shell.
Wh, total number of whorls in shell.
*, specimen incomplete.

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Age of the Faunas

In the past, the age of the Lilydale Limestone has been the subject of some contention and frequent revision. Strusz (1972) assessed the evidence presently available from a number of groups and regarded the Lilydale Limestone as being Late Siegenian in age.

Strusz (1972) considered the '*Receptaculites*' Limestone at Taemas, in which *Michelia darwini* (de Koninck) occurs, to be Emsian in age.

However, Philip (1974) summarized recent developments in Europe which have placed the relationship of the stages in the different facies of the Lower Devonian in a state of flux. He commented, 'How sterile now seems the debates as to whether certain limestone horizons in eastern Australia are Siegenian or Emsian (or even Pragian) in age'. As yet the relationship of these stages in Europe has not been resolved.

This revision of the gastropod fauna makes little contribution to the age determination because of the present inadequate knowledge of gastropod faunas both in Australia and overseas. Most of the genera represented at Lilydale are characterized by such long ranges that they are of little value in age determinations. The remaining few genera with relatively short ranges such as *Scalaetrochus* are of limited value because of their restricted distribution.

Relationships of the Fauna

Representatives of eight gastropod superfamilies, murchisoniaceans, euomphalaceans, bellerophontaceans, pseudophoraceans, pleurotomariaceans, oriostomataceans, neritaceans and loxonemataceans are described from the limestone at Lilydale. As well as these there are the two species of turbiniform gastropods previously assigned to the genus *Cyclonema*.

Comparison with other Lower Devonian faunas in Australia is limited by the notable lack of recent studies. The closest fauna geographically that is described, is that of the Marble Creek Limestone (Talent and Philip, 1956). This fauna is dominated by platyceratids, although species of *Tremanotus* and *Michelia* are known at Marble Creek as well as Lilydale. Chapman (1907, p. 73) also noted the presence of *Scalaetrochus* sp., but this has not been subsequently verified.

The gastropod fauna from the limestones at Taemas, N.S.W., as described by de Koninck, has only a limited number of genera in common with Lilydale. *Michelia darwini*, described here, is very similar in shape to *M. brazieri* from Lilydale. Although de Koninck only described small bellerophontids from Taemas such as *Bellerophon convolutus* de Koninck, large forms comparable in size to *B.* (*B.*)*cresswelli* Etheridge are known to occur as well. Otherwise the gastropod faunas differ considerably, with Taemas possessing an abundance of small high spired forms, whereas such forms are generally absent at Lilydale.

Boucot (1975) summarized the now considerable amount of work on Devonian palaeogeography. During the Lower and Middle Devonian a very marked provincialism developed when compared with the preceding Silurian period and succeeding Late Devonian. This provincialism was greatest during the Siegenian, Emsian and Eifelian. During the Siegenian three realms, Malvinokaffric, Old World and Eastern Americas have been recognized, principally on the basis of brachiopods. Other groups including trilobites, corals and conodonts also support this biogeographic scheme. Within the Old World realm a number of regions or sub-provinces are recognized. It is within one of these, the Tasman sub-province, that Lilydale is located.

Boucot has observed that during 'the early Devonian the oriostomatids—poleumitids, tremanotids and euomphalids are present only in the Old World Realm as "Silurian holdovers" (relicts).' They also tend to be particularly characteristic of the Bohemian facies of the Old World Realm.

The gastropod fauna at Lilydale strongly supports this palaeobiogeographical scheme. Fifteen per cent of the fauna consists of relict genera *Tremanotus*, *Straparollus* (*Euomphalus*) and *Oriostoma*. These relict genera also tend to emphasize the greater similarity between Lilydale and the gastropods of the Bohemian facies, rather than with the sandier Rhenish facies of the Rhenish-Bohemian sub-province. The dextrally coiled *S.* (*E.*) *northi* is very like the similarly coiled *S.* (*E.*) *carnicus* (Frech) from the Carnac Alps. Also present in the Lower Devonian limestones of the Carnic Alps are species of *Bellerophon*, *Phanerotrema* and *Stenoloron* which are very similar to the species of these genera at Lilydale. Spitz (1907, pl. 13, fig. 16 a and b) illustrated a species of *Polytropis* from the Carnic Alps which is closely similar to the species assigned to *'Cyclonema'* at Lilydale. Jhaveri (1969) considered that the Carnic Alps gastropod fauna shows a close relationship with the gastropod faunas from the Lower Devonian of Bohemia, Northern France and New York as does the fauna from Lilydale.

Palaeoecology

Two gastropod groups dominate the fauna, the murchisoniaceans and the species of *'Cyclonema'*. They constitute about 31% and 25% of the fauna respectively. The euomphalaceans, bellerophontaceans and pseudophoraceans are the next most abundant groups in the fauna comprising 13%, 11% and 9% respectively. The remaining four superfamilies each comprise about 3% of the fauna.

In terms of general shape, the turbiniform to high spired forms comprise about 70% of

the fauna and the other 30% consists largely of discoidal and planispiral forms. About 80% of the fauna is either medium sized or large, although this may in part be an artifact of selective collecting. However, field comparisons of the abundance of smaller forms at Lilydale, Buchan and Taemas indicate a very much greater abundance at the latter two localities than at Lilydale.

At Lilydale the most distinctive feature of the fauna is the total absence of members of the Family Platyceratidae which is presently characterized by a cophrophagous mode of life. The two species of *'Cyclonema'* described from Lilydale possess an operculum (Yochelson and Linsley, 1972), lack any apertural or coiling irregularity and possess no other feature that could be suggestive of a cophrophagous mode of life. Thus their association with the platyceratidae would greatly distort any interpretation of the environment of the fauna.

Not only is there a general absence of platyceratids at Lilydale, there is also a general lack of crinoidal remains in the limestone. A significant percentage of the crinoidol remains present are composed of fragments of *Pernerocrinus* (Bates, 1972). This is in marked contrast to the gastropod fauna of the Marble Creek limestone. This latter fauna, dominated by platyceratids, occurs in a limestone composed in large part of crinoidal fragments. The fauna is also notable for its low taxonomic diversity in comparison with the diversity at Lilydale.

A similar situation is seen in the diversity of the gastropod fauna in the Silurian reefal complexes of Gotland, Sweden. The reefal limestones in which Manten (1971) observed gastropod faunas had a considerably more diverse fauna than that of the associated crinoidal limestones.

Linsley (1968) in his description of the Middle Devonian gastropods of the Anderdon Limestone recognized two principal habitats. One of these is a 'biostromal' environment where small snails lived on the carbonate mud flats between the corals and stromatoporoids in relatively shallow water. The gastropods of the other habitat, that of the 'inter-reef' lived on the carbonate muds developed between sparse, localized tetracoral assemblages. This fauna was distinguished by its considerably larger size, 1″-5″ being the maximum dimension. Also present were a few nautiloids, articulate brachiopods and some ostracodes. Linsley considered that the fauna and the sediment suggested a fairly quiet environment.

The composition of the fauna of Lilydale resembles reasonably closely the fauna of Linsley's inter-reef habitat. Both are dominated by large forms although more of these are high-spired types at Lilydale. However, the first species of *Scalaetrochus* to be recorded outside south-eastern Australia was described by Linsley from the Anderdon Limestone. Thus the similarity of sediment and fauna suggest that the gastropods of the Lilydale Limestone occupied an environment somewhat similar to the inter-reef environment of the Anderdon Limestone.

Yochelson and Dutro (1960) in their description of a Mississippian and Permian gastropod fauna from limestones in northern Alaska also made some comments on the palaeoecology of the assemblages. They observed that *'Platyceras* commonly occurs here in crinoidal limestones'. This is in accordance with its distribution in the limestones at Gotland, Marble Creek and Lilydale. Where *Platyceras* is common in the Lower Mississippian sediments, 'the associated gastropods show less variety than in the Upper Mississippian' (where *Platyceras* is less common). Again this is comparable with the situation at Lilydale and Gotland.

However, they noted that 'corals and gastropods also appear to be nearly mutually exclusive' and that 'gastropods are commonly associated with numerous taxonomically diversified brachiopods'. At Lilydale a situation quite the reverse exists. Gastropods and corals are very closely associated while only a depleted and restricted brachiopod fauna is present.

That such diverse gastropod associations exist only serves to emphasize the need for further work on this group before more meaningful generalizations on gastropod palaeoecology can be made.

Systematic Descriptions

Superfamily BELLEROPHONTACEA McCoy, 1851
Family SINUITIDAE Dall *in* Zittel-Eastman, 1913
Subfamily TREMANOTINAE Peel, 1972
Genus Tremanotus Hall, 1865
(= *Boiotremus* Horny, 1962).

Type Species: Tremanotus alpheus Hall, 1865; Middle Silurian; Bridgeport, Illinois, U.S.A.
Range: Middle Ordovician to Lower Devonian. The presence of *T. pritchardi* at Lilydale and *T. fortis* Frech and *T. insectus* Frech in the Upper Koněprusy Limestone, Koněprusy extends the upper range of the genus from Middle Silurian to Lower Devonian.
Discussion: Knight *et al.* (1960) provided a diagnosis for this genus in which the slit is 'represented by a row of tremata, all but the last few closed, not extending on to expanded lip'. Subsequently Horny (1963) amended this diagnosis to read, 'slit represented by a row of tremata in body whorls, not extending on the expanded lip; no tremata but shallow sinus in outer lip in young stages'. Horny (1962) also erected a new genus, *Boiotremus*, characterized by 'tremata present along the whole length of the whorls, periodical widened apertures after distances of 1-3 tremata'. It is into this latter genus that most of the species previously assigned to *Tremanotus* would be placed.

In his discussion of the genus *Tremanotus* he noted that the 'main and characteristic sign is the existence of the five opened tremata in the body whorl region. In the ontogenetically younger stage there are no tremata developed . . .' This interpretation is inconsistent with *T. alpheus* as described by Hall and Knight's (1941) redescription which Horny (1963, p. 97) suggested implicitly supported his case. Knight noted '6-8 tremata remaining open' and 'the earlier ones (were) filled'. That there are more than 5 tremata can be clearly seen in Knight's figures of the type species. The figures of Clarke and Ruedemann (1903) also clearly indicate that the presence of tremata is not confined to the body whorl. Unfortunately the preservation and orientation of the specimens figured by Horny does not show the dorsal surfaces of the earlier whorls.

Thus Horny's amendment of the diagnosis of *Tremanotus* is based upon a misconception and is without justification. The new genus *Boiotremus* to which he attributed 'all tremanotids' which have developed tremata during the whole life of the specimen, i.e. in all ontogenic stages' is thus a synonym of *Tremanotus*.

Horny (1963, p. 97) in his discussion of *Tremanotus* as redefined by himself, considered that both the tremata and the flared aperture were features which developed only at maturity. However, the development of the tremata was dependent upon the development of the flared aperture. This concept of the growth sequence with its inherent reorganization of the exhalent system is without justification because of the presence of tremata throughout the development of the entire shell.

Tremanotus pritchardi Cresswell, 1893 (Pl. 1, fig. 17)

1893 *Tremanotus pritchardi* Cresswell, p. 42, pl. 8, fig. 1.
1913 *Tremanotus pritchardi* Cresswell; Chapman, p. 227.
1916 *Tremanotus pritchardi* Cresswell; Chapman, p. 79 in part.

Diagnosis: Large form of genus in which the relationship between major growth rugae and tremata is variable; numerous fine growth lines and open tremata are present.
Description: Large planispiral gastropod with a widely expanded aperture in the final growth stage; wide umbilici; whorl profile gently arched dorsally, more strongly curved on the sides turning sharply into the wide and deep umbilici, flattened on the inner surface; aperture in final growth stage sub-oval; neither a sinus nor tremata are developed on the dorsal surface of the expanded region of the aperture; posterior to the expanded apertural region, the existence of a small sinus situated medially on the dorsal crest of the whorl is indicated by a slight posterior flexure of the growth lines; along the resultant selenizone numerous ovoid tremata are developed, the most anterior trema is represented by a solid protrusion over which growth lines pass; then follows a number of open tremata, up to 11, the tremata preceding

the open tremata are sealed and flush with the whorl surface; beween tremata the growth lines are directed posteriorly towards the earlier tremata; as well as the closely spaced growth lines, prominent growth rugae are developed; the relationship of the growth rugae to the tremata is variable; in some cases the rugae intersect the selenizone between tremata, in others at the trema; sculpture is composed of numerous spiral costae which arise in the umbilici; sculptural elements vary from one to three orders, sculpture and growth lines form a reticulate pattern over the entire whorl surface.

Dimensions:

	L	Wt	Lap	Wap	Wlt	Wh
M.U.G.D. 1666	92	56	46	43	35	5+
P914	—	47	43	40	33	—

Location of Types: Melbourne University Geology Department. Holotype, M.U.G.D. 1666 and counterpart M.U.G.D. 1667, G. B. Pritchard Coll.

Material: Holotype, counterpart, and 12 other specimens.

Discussion: This species is distinguished from the type species, *T. alpheus*, by having more open tremata, up to 11 as compared to the latter's 6 to 8. Transverse growth lines, principally fine ones of a type lacking in the American form, are more abundant. The relationship of the growth rugae and the tremata is quite variable in the Lilydale form. However, rugae only occur between tremata in the type species. The last potential trema is closed, whereas no mention of this was made by Knight (1941, p. 354) in his redescription of the type species.

Knight postulated that the tremata were formed during periods of growth when the flared aperture was not being deposited. At such times a shallow sinus in the outer dorsal lip formed a short slit, subsequently closed anteriorly by growth of the flared aperture. The flared aperture was then resorbed, the prominent growth rugae marking the point to which resorption occurred. This was followed by the initial growth type in which another trema was formed. This cycle was repeated numerous times as is indicated by the number of tremata.

Material from Lilydale suggests a mode of growth in *T. pritchardi* different from that postulated by Knight.

Initial growth, as in *Haliotis,* saw the development of a short sinus, which with subsequent growth of the apertural lips was closed, so forming a trema. Then followed a period in which only an exceedingly narrow and shallow sinus was developed. Subsequently this sinus deepened and another trema formed. With growth, earlier tremata were no longer required and sealed as in *Haliotis.* This process of growth continued until the animal reached its penultimate growth stage. At this point the mode of growth changed. No longer was a sinus formed. Rather the prominent flared aperture was developed. Frequently the sculpture present on the flared aperture is quite different to the rest of the shell, e.g. all but the first order spiral sculpture may be absent.

This growth cycle differs from that suggested by Knight, in that it does not require the flared

PLATE 1

Fig. 1 —*Michelia darwini* (de Koninck), ANU 36852, hypotype, Bloomfield Property, Yass, N.S.W., XI.

Fig. 2 —*Michelia darwini* (de Koninck), ANU 36853, hypotype, Bloomfield Property, Yass, N.S.W., XI.

Fig. 3 —*Michelia brazieri* (Etheridge), P1058, hypotype, XI.

Fig. 4 —*Loxonema australis* (Chapman), P38508, hypotype, XI.

Fig. 5 —*Michelia brazieri* (Etheridge), P1059, hypotype, XI.

Fig. 6 —*Bellerophon* (*Bellerophon*) *cresswelli* Etheridge, P12838, hypotype, X 2/3.

Fig. 7 —*Straparollus* (*Euomphalus*) *northi* (Etheridge), P28716, hypotype, X 2½.

Fig. 8 —*Straparollus* (*Euomphalus*) *northi* (Etheridge), P28714, hypotype, X 2/3.

Figs. 9-10—*Naticopsis* (*Naticopsis*) *lilydalensis* Cresswell, P37740, hypotype, XI.

Figs. 11-12—*Planerotrema australis* Etheridge, F. 1332, syntype, X 1½ (approx.).

Fig. 13—*Scalaetrochus lindströmi* Etheridge, F.1137, holotype, X 2/3.

Fig. 14—*Stenoloron subaequilatera* (Chapman), P37643, hypotype, X 2/3.

Fig. 15—*Scalaetrochus lindströmi* Etheridge, F.1137, holotype X 2/3.

Fig. 16—*Scalaetrochus lindströmi* Etheridge, P38505, hypotype X 2/3. Basal view showing open umbilicus.

Fig. 17—*Tremanotus pritchardi* Cresswell, M.U.G.D. 1666, holotype, X 2/3.

Fig. 18—*Scalaetrochus lindstromi* Etheridge, F.1137, holotype, X 2/3. Basal view.


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aperture to be deposited and resorbed numerous times. Here the flared aperture is considered to be a gerontic feature. It is also considered that the type species mode of growth was the same as that of *T. pritchardi.*

In his discussion of *Boiotremus*, Horny (1963, p. 101) noted the presence of tremata throughout the entire life of the specimen and the development of periodically widened apertures. He did not describe the extent and nature of this 'periodical widened aperture'. That *Tremanotus* did not develop a large flared aperture periodically has been discussed earlier. Horny did not make mention of resorption of this widened aperture. The only other method of removal would be purely mechanical by abrasion. Whatever the method, the removal of this region results in the formation of a feature he termed a 'sear'. This is in fact the same as the major growth rugae observed in the type species and the species from Lilydale. As previously noted the distribution and degree of development of these growth rugae is quite variable amongst members of the same species and between different species. This is also true of the species figured by Horny.

Although Horny (1963) figured two specimens NM-L5727 and NM-L5729 (Pl. 26, fig. 2 and Pl. 27, figs. 2, 3, 4 and 5) which he considered show the widened aperture, these specimens could equally as well be mature specimens with badly damaged expanded apertural regions. Because of the great variability in the development of the growth rugae or 'scars' it is considered highly unlikely that the widened apertures as described by Horny were developed. To demonstrate their existence unequivocally would require a mature specimen with both the final expanded apertural region and the older widened apertures preserved. Their appearance would be much the same as varices of certain gastropods. If, in fact they do exist, their great variability as reflected by the growth rugae or 'scars' would make them unsatisfactory as a generic characteristic.

Chapman (1916, p. 79) mentioned a specimen from Marble Creek, Thomson River, Victoria. Subsequently Talent and Philip (1956) described a new species *T. cyclocostatus* from this locality. This is distinguished from *T. pritchardi* by its considerably smaller size and much finer growth lines and sculpture. It also has fewer foliaceous growth rugae and those that are present are irregularly developed.

Subfamily Bellerophontinae McCoy, 1851.

Genus Bellerophon Montford, 1808

Subgenus Bellerophon (Bellerophon) Montfort, 1808

Type Species: Bellerophom vasulites Montfort, 1808; Middle Devonian; The Eifel, Germany.

Bellerophon (Bellerophon) cresswelli Etheridge, 1891

(Pl. 1, fig. 6; Pl. 3, figs. 3, 4, 5, 6, 9)

1891 *Bellerophon cresswelli* Etheridge, p. 130, pl. 19, figs. 6-8.
1913 *Bellerophon cresswelli* Etheridge; Chapman, p. 227.
1916 *Bellerophon cresswelli* Etheridge; Chapman, p. 80, pl. 2, fig. 12, pl. 4, fig. 53.
1916 *Bellerophon pisum* Chapman, p. 80 pl. 2, figs. 9-11.

Diagnosis: Typical form of genus with thickened outer lip which extends posteriorly beyond the umbilical region; broadly crescentic aperture; selenizone only slightly elevated and bordered by two fine threads; sculpture composed of very fine transverse elements.

Description: Medium, subglobular, narrowly umbilicate planispiral gastropod with broad involute whorls; whorl profile gently arched dorsally, more strongly curved on the sides, turning sharply into the narrow umbilici; aperture very broadly crescentic; margin of outer lip not flared anteriorly but flared outward in the lateral and umbilical regions, margin continues across the parietal wall as a moderately thick inductura which thickens considerably towards the lateral margins, greatest thickness at the junction of the flared outer lip and parietal wall; narrow, moderately deep slit on outer lip generating a dorsal selenizone which is very slightly raised above the whorl surface and bordered by two very fine threads; sculpture consists of fine transvere growth lines with occasional growth rugae, holotype has about seven whorls.

Dimensions:

	L	Wt	Lap	Wap	Wh	Sw
F.1327	—	37	29	25	7	1
P293	48	47	23	41	—	0·6
P1087	11	10	3*	7·3	—	0·4
P12837	41	44	37	40	—	—
P12838	44	43	37	25*	—	1
P34938	12	12	3	9*	—	0·4

Location of Types: 1. *B. cresswelli*, Australian Museum, Holotype, F.1327. National Museum of Victoria, Hypotypes, P12838, P34938. G. Sweet Coll.

2. *B. pisum*, National Museum of Victoria, Holotype, P1087, A. W. Cresswell Coll.

Material: Holotype, 3 hypotypes and 37 other specimens.

Discussion: The holotype is partially broken, revealing the inner whorls which number about seven. This species is distinguishable from the similar sized type species *B. (B.) vasulites* by a number of features. The aperture of *B. (B.) cresswelli* is more broadly crescentic in shape. The outer lip is considerably thicker in the Lilydale form and extends further posteriorly beyond the umbilici. The selenizone of the type species is raised further above the whorl surface and bordered by shallow depressions rather than the fine threads of the Lilydale form. Transverse sculpture in *B.* (*B.*) *cresswelli* is considerably finer, particularly in the regions near the selenizone.

Chapman (1916, p. 80) referred to a well preserved specimen in the National Museum of Victoria collection which exhibits 'a faint but definite lattice structure of wavy striae across the growth lines'. However, none of the specimens examined in this study possess such ornamentation.

During growth *B.* (*B.*) *cresswelli* changed slightly in form. The aperture became more flared. In the juvenile form, flaring was confined to the umbilical region, but with growth the lateral areas of the outer lip also became flared. Initially quite thin, the inductura also thickened with growth, as did the outer lip. The influence of thickening is quite marked in the change of shape of the junctions of the parietal inductura and outer lip. In the juvenile forms, a marked, moderately deep channel is present, whereas in the older forms the channel is considerably shallower. The sculpture also changes from being quite wide, regular and nearly foliaceous in smaller forms to generally closer, finer but more irregular and variable in the larger forms.

Chapman (1916, p. 80) described *B.* (*B.*) *pisum* from Lilydale. He did not indicate specifically how it is distinguishable from this species. Presumably it is because of its smaller size, distinct sinus in the outer lip and sculpture of 'interrupted radial striae . . . between the lines of growth'. However, none of the features that Chapman mentioned in his description of *B. pisum* are unique. All these features are found in specimens of *B.* (*B.*) *cresswelli*, particularly the smaller forms. It is considered that *B. pisum* is a juvenile of *B. (B.) cresswelli.*

Superfamily EUOMPHALACEA de Koninck, 1881

Family EUOMPHALIDAE de Koninck, 1881

Genus Straparollus Montfort, 1810

Subgenus Straparollus (Euomphalus) J. Sowerby, 1814
(= *Liomphalus* Chapman, 1916)

Type Species: Euomphalus pentangulatus J. Sowerby, 1814; Lower Carboniferous; near Dublin, Ireland.

Discussion: Chapman (1916, p. 90) erected the genus *Liomphalus* which he distinguished from *Euomphalus* in having 'smooth rounded uniangulated whorls', and from *Straparollus* in possessing a concave spire. The genus is characterized by the following: discoidal; base concave; wide umbilicus; spire depressed; whorls smooth, sometimes with keel; whorls thicken progressively, in the late stages free or adpressed.

Knight (1941, p. 174) considered it 'utterly impossible to arrive at any comprehension of the genotype species except by comparison with the adequately described species of other authors referred by Chapman to his genus'. Later, Knight (1944, p. 465) placed it in synonomy with *Lytospira* Koken.

Philip and Talent (1959, p. 50) demonstrated that the genus *Liomphalus* is based on the internal moulds of *Straparollus* (*Euomphalus*) *northi* (Etheridge). Their conclusions

are amply supported by many specimens in the collections studied.

Straparollus (Euomphalus) northi (Etheridge), 1890

(Pl. 1, figs. 7, 8. Pl. 2, fig. 11. Pl. 3, figs. 1, 2, 7, 8)

1890 *Oriostoma northi* Etheridge, p. 64, pl. 9, figs. 6-7.
1894 *Oriostoma northi* Etheridge, p. 151, pl. 9, figs. 1-4.
1894 *Euomphalus* (*Oriostoma*) *northi* Etheridge; Cresswell, p. 157.
1913 *Euomphalus northi* (Etheridge); Chapman, p. 227.
1916 *Euomphalus northi* (Etheridge); Chapman, p. 90.
1916 *Liomphalus australis* Chapman, p. 90, pl. 4, figs. 32-33.
1959 *Straparolus* (*Euomphalus*) *northi* (Etheridge); Philip and Talent, p. 50, pl. 7, figs. 1-12, pl. 8, figs. 1-2.
1972 *Oriostoma northi* Etheridge; Yochelson and Linsley, p. 8, pl. 1, fig. 6, pl. 2, figs. 1-5.

Diagnosis: Dextrally coiled discoidal gastropod; variably developed angulations on upper and lower whorl surfaces; sculpture initially consists of strong transverse costae becoming less developed with growth.

Description: Medium to large discoidal dextral gastropod; numerous whorls with profile flat to gently convex and inward sloping between the upper suture and the variably developed upper keel at the junction of the upper and outer whorl surfaces; more than one keel may be developed on the upper surface; the prominence of the keel or keels tends to decrease with increased size; the junction of the outer and basal whorl surfaces is generally less pronounced than that for the upper surfaces; sutures impressed; base strongly arched; very wide umbilicus; spire depressed; aperture circular; columellar lip thin, concave parietal lip thin; outer lip slightly thicker and it extends outwards radially from the upper suture to the outer whorl surface where a mild concave flexure is sometimes developed, and then continues inwards across the base radially to the suture; no sinus or flexure of growth lines is developed at the keel, if present; sculpture is variably developed on specimens of different size and on the one specimen; the smaller specimens and the inner whorls of the larger specimens possess prominent transverse ridges; on the larger specimens, fine growth lines gradually succeed the prominent juvenile sculpture; sculpture on the base while similar to that on the upper and outer surfaces is less strongly developed; transverse partitions occur in early whorls; multispiral operculum of numerous fine whorls of variable thickness, circular in shape; whorls are normally visible on the plano-concave exterior surface; the concave internal surface is smooth being composed of laminae deposited nearly at right angles to the opercula rim; the degree to which the internal surface is concave is quite variable; a shallow central depression occupies about one-third of the inner surface; thickness is variable, even for opercula of the same diameter; operculum fits tightly in the aperture, being retracted into the shell for about 2 mm.

Dimensions:

	Ht	Wt	Hap	Wap	Wh
F.1321a	13·5	74	—	—	4
F.1139e	20·2	51	—	—	—
P1107	25*	71	23	23	4
P2503	—	54	—	—	3
P7609	—	60	—	—	—
P28373	32	97	—	—	—
P28498	19	63	—	—	4+
P28499	—	59	—	—	—
P28707	14	49	—	—	3+
P28711	25	77	—	—	4+
P28712	27	77	—	—	3+
P28714	16	44	—	—	4
P28716	10	19	—	—	4
P28719	7	14	—	—	—
P34300	27	54	—	—	4

Location of Types: 1. *Oriostoma northi*, Australian Museum. Holotype, F.1321a, Paratype, F.1139e. National Museum of Victoria. Hypotypes, P1107, P1115. A. W. Cresswell Coll. P26890, P28499, P28714, P28716, P28718, P28719. E. D. Gill Coll. and P34300-34302 which were formerly GSV 55329, 55330 and 55332.

2. *Liomphalus australis*, National Museum of Victoria. Holotype, P7609, Paratype, P2503. A. W. Cresswell Coll.

Material: Holotype, paratype, 13 hypotypes and 49 other specimens.

Discussion: Comparison of *S.* (*E.*) *northi* with the type species *S.* (*E.*) *pentangulatus* reveals a number of differences. The former has a shallower, wider umbilicus and is coiled dex-

trally. Its upper keel is less strongly developed and there is an absence of spiral sculptural elements. The sculpture of the Lilydale form is more variable; initially the transverse elements are much stronger than those of the type species but finally they are considerably weaker. The sculpture is also less evenly developed on the upper and basal whorl surfaces.

The dextral coiling of *S.* (*E.*) *northi* is also a feature of *S.* (*E.*) *carnicus* (Frech). As figured by Jhaveri (1969, pl. 21, fig. 8) this species also possesses strong transverse sculptural elements as does *S.* (*E.*) *northi*. It also probably possesses an operculum which is very similar to that of *S.* (*E.*) *northi*, (Yochelson and Linsley 1972, p. 9).

Yochelson and Linsley (1972, p. 8) described the operculum from *S.* (*E.*) *northi* and compared it with very similar types found in a number of other genera which belong to more than one family. Because of this they suggested implicitly that a revision of these families was needed. Thus they preferred to leave the species from Lilydale in the genus *Oriostoma* as originally determined by Etheridge. However, comparison of *S.* (*E.*) *northi* with *Oriostoma barrandei* Munier-Chalmas, the type species reveals sufficient differences to preclude it from belonging to the latter genus. *S.* (*E.*) *northi* is discoidal rather than turbiniform and has a much wider umbilicus. There is an absence of the spiral sculpture characteristic of the type species. The form from Lilydale has a more angular whorl profile and its aperture is more circular in shape.

Superfamily PLEUROTOMARIACEA Swainson, 1840

Family PHANEROTREMATIDAE Knight, 1956

Genus Phanerotrema Fischer, 1885

Type Species: Pleurotomaria labrosa Hall, 1860; Lower Devonian; Carlisle, New York, United States of America.

Phanerotrema australis Etheridge, 1891
(Pl. 1, figs. 11, 12. Pl. 2, figs. 3, 10, 12)

1891 *Phanerotrema australis* Etheridge, p. 128, pl. 19, figs. 4-5.

1913 *Phanerotrema australis* Etheridge; Chapman, p. 227.

1916 *Phanerotrema australis* Etheridge; Chapman, p. 83, pl. 3, fig. 25.

Diagnosis: Typical form of genus with thick, short, straight columellar lip, well-developed parietal inductura and simple rectangular sculpture pattern arising from the intersection of the collabral growth lines and spiral cords.

Description: Large, turbiniform gastropod with few whorls; whorl profile sub-angular, gently arched above and below the selenizone at the angular periphery; periphery high above midwhorl; sutures deeply impressed to sub-canaliculate; body whorl greatly expanded; umbilicus absent; columellar lip thickened, continuous with the thick extensive parietal inductura; outer lip thin with a broad sinus that forms a shallow slit at the periphery which gives rise to the selenizone; from the upper suture to the selenizone outer lip very gently prosocline; below the selenizone the outer lip is gently prosocline; gently concave selenizone moderately wide, and bordered by two threads; fine collabral growth lines and infrequent growth rugae, cancellated by two orders of fine spiral cords to form a rectangular pattern over the entire whorl surface, occasional specimens have a retroussé intersection.

PLATE 2

Fig. 1 —*Michelia brazieri* (Etheridge), F.1145, holotype, XI (approx.).

Fig. 2 —*Gyrodoma etheridgei* (Cresswell), F.2542, hypotype, XI (approx.).

Fig. 3 —*Phanerotrema australis* Etheridge, P.41706, hypotype, X 2/3.

Fig. 4 —*Siluriphorus antiquus* (Cresswell), P918, hypotype, XI. Oblique basal view.

Fig. 5 —*Scalaetrochus lindströmi* Etheridge, P39279, hypotype, X 1½ (approx.). Basal view showing prominent peripheral frill.

Fig. 6 —*Siluriphorus antiquus* (Cresswell), P917, holotype, XI. Apical view.

Fig. 7 —*Oriostoma rotundimuratus* sp. nov., P1089, holotype, Apical view.

Fig. 8 —*Loxonema australis* (Chapman), P12851, holotype, X 1½.

Fig. 9 —*Gyrodoma etheridgei* (Cresswell), P10187, holotype, X 1.

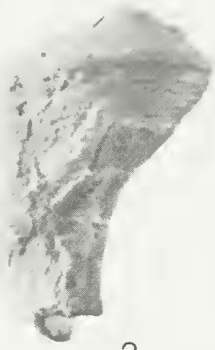
Fig. 10—*Phanerotrema australis* Etheridge, F.39308, syntype, X 2/3.

Fig. 11—*Straparollus* (*Euomphalus*) *northi* (Etheridge), F.1321a, holotype, X 2/3. Apical view.

Fig. 12—*Phanerotrema australis* Etheridge, F.39308, syntype, X 2/3.


1


2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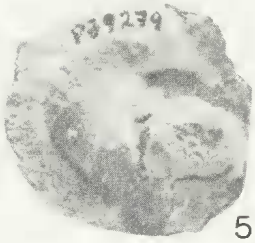
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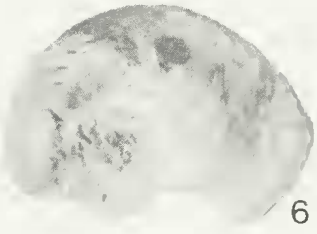
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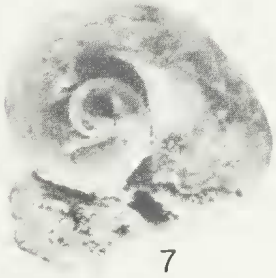
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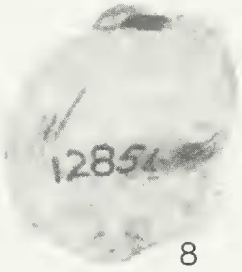
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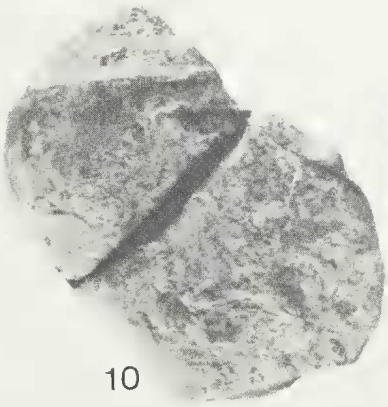
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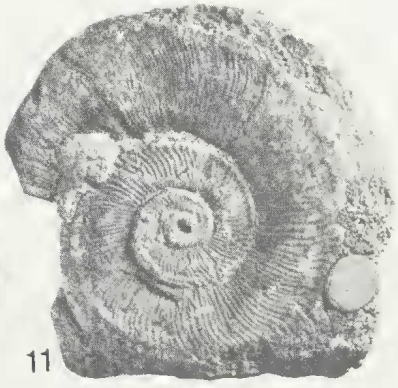
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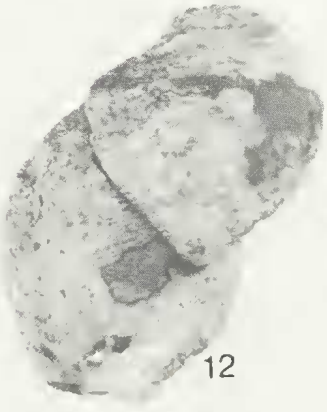

12

Dimensions:

	Ht	Wt	Hap	Wap	Wh	Clu	Cll
F.1332	24	21	—	—	4	14	16+
F.39308	82	73	—	—	2+	—	—
P384	63*	47	—	—	3+	29	31
P12841	93	78	—	—	4	28*	28*

Location of Types: Australian Museum. Syntypes, F.1332 and F.39308. National Museum of Victoria. Hypotypes, P12841, presented by Dr E. Brooke Nicholls and P41706, A. W. Cresswell Coll.

Material: Two syntypes, 2 hypotypes and 12 other specimens.

Discussion: P. Australis differs from the type species in having a straighter, more thickened and longer columellar lip. The type species' columellar lip is markedly curved. The parietal inductura on the form from Lilydale is also thicker than that of the type species. The intersection of the collabral growth lines and spiral sculptural elements in the type species is retroussé, whereas that of the Lilydale form is generally considerably simpler.

Family GOSSELETINIDAE Wenz, 1938

Genus Stenoloron Oehlert, 1888

Type Species: Pleurotomaria viennayi Oehlert, 1888; Lower Devonian; Saint-Roch (La Baconnier), département de la Mayenne, France.

Discussion: The presence at Lilydale of a member of this genus extends the known distribution as it was previously confined to Europe and North America.

Stenoloron subaequilatera (Chapman), 1916
(Pl. 1, fig. 14)

1916 *Mourlonia subaequilatera* Chapman, p. 83, pl. 3, figs. 18-19.

Diagnosis: Typical form of genus with a selenizone bordered by two cords close to mid-whorl periphery and finely developed spiral elements of sculpture.

Description: Medium rotelliform, umbilicate gastropod; whorl profile well rounded, convex; moderately impressed sutures; base rounded; aperture known only in part; outer lip with a moderately deep and angular sinus that forms a slit which gives rise to a narrow selenizone; selenizone located about one-third of the way between the mid-whorl periphery and upper suture; between the upper suture and the selenizone the outer lip is prosocline with a moderate obliquity; below the selenizone it is prosoeyrt, passing forwards for a short distance before rounding gently and passing nearly radially across the base; inner lip not known; selenizone depressed and bordered by two moderately developed cords; collabral lines strongly developed; very subdued elements of spiral sculpture.

Dimensions:

	Ht	Wt	Hap	Wap	Wh	Sw
P925	16	22	—	—	5	0·4
P37643	56	61	—	—	6	0·8

Location of Types: National Museum of Victoria. Holotype, P925, A. W. Cresswell Coll. Hypotype, P37643.

Material: Holotype, hypotype and 2 other specimens.

Discussion: S. subaequilatera is represented by only a few specimens, none of which is complete. However, it is possible to distinguish it from the type species as known on the basis of Oehlert's original figures and description. The type species' selenizone is located about mid-way between the periphery and upper suture whereas that of the Lilydale form is considerably closer to the periphery. The form from Lilydale also possesses two cords bordering the selenizone and fine spiral elements of sculpture. As figured by Oehlert (1888, pl. 9, figs. 2 and 2a) it is quite possible that the cords are present although not mentioned in the description. However, there is no suggestion in Oehlert's figures of the presence of fine spiral elements of sculpture.

Superfamily ORIOSTOMATACEA Wenz, 1938

Family ORIOSTOMATIDAE Wenz, 1938

Genus Oriostoma Munier-Chalmas, 1876

Type Species: Oriostoma barrandei Munier-Chalmas, 1876; Lower Devonian; Bois Roux quarry at Gahard, near Rennes, France.

Oriostoma rotundimuratus sp. nov.
(Pl. 2, fig. 7)

1916 *Omphalotrochus globosum* (Schlotheim); Chapman, p. 92, pl. 4, figs. 35-36.

Diagnosis: Small form of genus very similar

to the type species but with stronger sculpture and more subdued collabral lines.

Description: Small, low spired, turbiniform gastropod with a few whorls in slight contact; outer whorl frequently disjunct; whorls increase rapidly in size, body whorl large; whorl profile rounded, arching upwards from the upper suture to the sub-rounded shoulder, then arching more gently to the lower slightly less rounded basal angulation surrounding the umbilicus, finally passing in a gentle convex arch to the umbilicus; sutures deep; umbilicate; columellar lip thin; parietal lip thin; outer lip thick, weakly prosocline; without sinus or slit; retroussé at the shoulder, and at each of the elements of spiral sculpture; sculpture composed of a number of strong spiral elements of at least two orders; collabral growth lines fine, slightly foliaceous and retroussé over each of the spiral sculptural elements.

Dimensions:

	Ht	Wt	Hap	Wap	Wh
P1089	7	12	—	—	3
P12850	7	—	—	—	3
P37644	5	7	—	—	3

Location of Types: National Museum of Victoria. Holotype, P1089; hypotype, P1088. A. W. Cresswell Coll.

Material: Holotype, hypotype and 7 other specimens.

Discussion: Comparison of *O. rotundimuratus* with the type species as redescribed by Knight (1941, p. 219) reveals few differences. The form from Lilydale has a more rounded whorl profile particularly in the region of the shoulder. While the collabral lines of the type species are more prominent, the spiral elements are weaker. The type species also possesses a more arcuate columellar lip and is slightly larger.

Chapman (1916, p. 93) considered this species to be *Trochilites globosus* Schlotheim (1820, p. 162). Comparison of the Lilydale form with this species is rather difficult, for Schlotheim's description is brief and he provided no figures. However, Lindström (1884, p. 162) studied the original specimen from Gotland upon which Schlotheim based his description. He synonymized *Euomphalus funatus* Sowerby (1823, p. 71) with it.

Comparison of the Lilydale form with illustrations of *E. funatus* indicates considerable differences between the two. The latter is more tightly coiled and has a thickened arcuate columellar lip. It also possesses fewer but more strongly developed spiral cords. The Lilydale form has less prominent collabral growth lines, but these are retroussé over the spiral elements, a feature apparently lacking in *E. funatus*. The sutures of *O. rotundimuratus* are also deeper.

Comparison of *O. rotundimuratus* with *Omphalotrochus globosum* (Schlotheim) as redescribed by Lindström (1884, p. 160) reveals numerous differences. The former is considerably lower spired with deeper sutures and wider umbilicus. The form from Lilydale possesses a straighter columellar lip and less rounded outer whorl profile. It also has less numerous and weaker spiral sculptural elements; nor do these elements exhibit a serrated to nodose appearance as in *O. globosum*. The Gotland form also lacks the retroussé intersection of the spiral and collabral elements as in *O. rotundimuratus*.

Superfamily	NERITACEA Rafinesque, 1815
Family	NERITOPSIDAE Gray, 1847
Genus	Naticopsis McCoy, 1844
Subgenus	Naticopsis (Naticopsis) McCoy, 1844

Type Species: Naticopsis phillipsi McCoy, 1844; Lower Carboniferous; Kilcommock, Longford, Ireland.

Range: Lower Devonian to Triassic. The presence of a species of this subgenus at Lilydale extends the lower limit of its range from the Middle Devonian to the Lower Devonian.

Naticopsis (Naticopsis) lilydalensis Cresswell, 1893

(Pl. 1, fig. 9, 10)

1893 *Naticopsis lilydalensis* Cresswell, p. 44, pl. 9, fig. 7.
1913 *Craspedostoma lilydalensis* (Cresswell); Chapman, p. 227.
1916 *Craspedostoma lilydalensis* (Cresswell); Chapman, p. 95, pl. 4, fig. 37.

Diagnosis: Form of genus with slight spire, rounded to only slightly extended base, dis-

tinctly auriform aperture, outer lip basal region thickened and excavated; slightly arcuate to straight, thick columellar lip.

Description: Medium, low spired, naticiform gastropod; whorl profile rounded with upper surface slightly flattened; shallow adpressed sutures; base rounded to slightly extended; without umbilicus; aperture auriform, outer lip slightly, irregularly, prosocline; moderately thin on upper and outer surfaces but thickens considerably on lower surface towards junction with the columellar lip, thickened region excavated; columellar lip thick, straight to slightly arcuate; parietal inductura variably developed, generally moderately thick; collabral lines fine and closely spaced, occasionally irregular; infrequently more prominent lines developed; no other sculpture.

Dimensions:

	Ht	Wt	Hap	Wap	Wh
P948	19	—	—	—	4
P949	—	22·6	—	—	—
P37740	30	29	20	16	4

Location of Types: National Museum of Victoria. Holotype, P948; Hypotypes P951 and P37740. A. W. Cresswell Coll.

Material: Holotype, 2 hypotypes and 10 other specimens.

Discussion: Absence of the apertural region on the holotype has resulted in some confusion as to which genus this species should be assigned. Chapman (1913, p. 227) ascribed this species to the genus *Craspedostoma* without reason. Subsequently in 1916, he noted (p. 95) that the base had an umbilicus and that 'in a supplementary speeimen, a part of the columellar area of the everted lip is preserved, which shows relationship to the above genus'. The hypotype P951 was considered by Chapman to possess an umbilicus. This specimen is in fact an internal mould, the umbilicus being the space that would have been occupied by the columella. No specimen has been found suggesting the presence of an 'everted lip'. Chapman also mentioned the presence of an obscure cancellated sculpture, consisting of flattened spiral and collabral ribs. Again no evidence for the presence of spiral elements has been found.

Comparison of *N. (N.) lilydalensis* with the type species reveals that it is slightly higher spired but has a less elongate last whorl. The form from Lilydale also has a more auriform aperture with a straighter columellar lip. The lower area of the outer lip is also considerably thicker. However, the parietal inductura of the type species is thicker.

Superfamily MURCHISONIACEA Koken, 1896
Family MURCHISONIIDAE Koken, 1896
Genus Murchisonia D'Archiac and De Verneuil, 1841
Subgenus Murchisonia (Murchisonia) D'Archiac & De Verneuil, 1841.

Type Species: Muricites turbinatus Schlotheim, 1820; Middle Devonian; *Stringocephalus* limestone, near Bladbach im Bergischen, Germany.

Murchisonia (Murchisonia) pritchardi (Etheridge), 1898
(Pl. 3, fig. 11, 12, 13, 14)

1898 *Goniostropha pritchardi* Etheridge, p. 71, pl. 15, figs. 1-4.
1913 *Murchisonia* (*Goniostropha*) *pritchardi* Etheridge; Chapman, p. 227.
1916 *Goniostropha pritchardi* Etheridge; Chapman, p. 88, pl. 4, fig. 29.
1916 *Cyrtostropha lilydalensis* Chapman, p. 87, pl. 4, figs. 26-28.

Diagnosis: Typical form of subgenus but possessing spiral sculpture above and below the selenizone.

Description: Medium, high spired, numerous whorled gastropod with a selenizone between two prominent cords at the angular periphery; the whorl face is flat to slightly concave both above and below the selenizone; sutures modcrately deep; base rounded; lacking umbilicus; columellar lip thin, arcuate and reflexed; junction of columellar and other lip not known; parietal inductura thin; outer lip with angular sinus that forms a slit at the periphery which generates the selenizone; from the upper suture to the selenizone the outer lip passes posteriorly with a moderate obliquity; below the selenizone it passes forwards to the base less strongly; selenizone concave; collabral lines fine and weakly developed; sculpture consists of a number of spiral cords above and below the selenizone; cords more numerous below the

selenizone than above it; none of the spiral cords are as strong as those bordering the selenizone.

Dimensions:

	Ht	Wt	Hap	Wap	Wh	Clu	Cll
F.4112	20·1	9·4	—	—	7	3	8+
F.4112	22·5	9·6	5·6	4·7	7	3	—
P935	12·9	7·7	4·1	3·6	4	3	—
P936	16·5	9·5	—	—	7	3	10
P941	18·0	7·5	5·6	4·1+	6+	—	—
P944	31·2	—	—	—	8+	—	—
P946	23·0	9·5	5·4	4·0	8	—	—

Location of Types: 1. *Goniostropha pritchardi,* Australian Museum. Syntypes F.4112. Of these 5 specimens, one is that figured by Etheridge, as figure 1, plate 15, another is that illustrated as figures 2 and 3, plate 15. The former of these two specimens is the most complete and is here designated the lectotype. National Museum of Victoria. Hypotypes, P935-940. A. W. Cresswell Coll.

2. *Cyrtostropha lilydalensis,* National Museum of Victoria. Holotype, P944. Paratype, P946. Hypotypes, P941-3, P945, P947.

Material: Lectotype, 4 paralectotypes, 13 hypotypes and 48 other specimens.

Discussion: Chapman (1916, p.88) distinguished *C. lilydalensis* from *G. pritchardi* on the basis of the former's shorter habit, more angulate whorls and deeper selenizone. However, these features vary independently of each other and such variation as does exist is considered to represent variation within a population only.

Chapman (1916, p. 88) suggested that the specimen of *Murchisonia* sp. mentioned by Etheridge (1891, p.129) might be *C. lilydalensis.* Re-examination of this specimen indicates that it is not. Rather it is a poorly preserved and crushed fragment of what appears to have been a moderately large specimen of *Michelia brazieri* (Etheridge).

M. (M.) pritchardi differs from the type species noticeably in possessing elements of spiral sculpture above and below the selenizone. The type species has a slightly more angular periphery and its growth lines above the selenizone pass backwards more obliquely. The Lilydale form has a slightly higher peripheral selenizone.

Genus **Michelia Roemer,** 1852

Type Species: Michelia cylindrica Roemer, 1854; Devonian; Bockswiese, near Clausthal, Germany.

Discussion: A new Palaeozoic subgenus of the Tertiary genus *Niso* (Risso) was erected by Etheridge (1890, p. 62). He considered that ultimately it would 'reveal an organization differing from *Niso* in which case I would propose for it the name *Vetotuba*'.

Although Etheridge (1890, p. 63) mentioned that *Niso darwini* de Koninck (1876, p. 127) from Yass had an umbilicus similar to *N. (Vetotuba) brazieri,* no reference to *N. darwini* was made in the generic description and discussion. Thus Knight (1941, p. 382) considered *Vetotuba brazieri* to be the type species.

Knight (1944, p. 459) synonymized *Vetotuba* with *Coelocaulus* (Oehlert). This latter genus was in turn synonymized by Knight *et al.* (1960, p. I292) with *Michelia,* as was *Vetotuba* itself.

Michelia brazieri (Etheridge), 1890

(Pl. 1, fig. 3, 5, Pl. 2, fig. 1)

1890 *Niso* (*Vetotuba*) *brazieri* Etheridge, p. 62, pl. 8, figs. 4-5, pl. 9, figs. 2-3.

PLATE 3

Fig. 1—*Straparollus* (*Euomphalus*) *northi* (Etheridge). P1115, hypotype, X 1½. Exterior of operculum.

Fig. 2 —*Straparollus* (*Euomphalus*) *northi* (Etheridge), P28719, hypotype, X 1½. Basal view.

Fig. 3. —*Bellerophon* (*Bellerophon*) *cresswelli* Etheridge, P1087, hypotype, X 3.

Figs. 4-6—*Bellerophon* (*Bellerophon*) *cresswelli* Etheridge, F.1327, holotype, X 1 1/3 (approx).

Fig. 7—*Straparollus* (*Euomphalus*) *northi* (Etheridge, P28499, hypotype, X 2/3. Section showing transverse partitions developed in early whorls.

Fig. 8 —*Straparollus* (*Euomphalus*) *northi* (Etheridge), F.1139e, paratype, X 1 (approx.).

Fig. 9 —*Bellerophon* (*Bellerophon*) *cresswelli* Etheridge, P34938, hypotype, X 3.

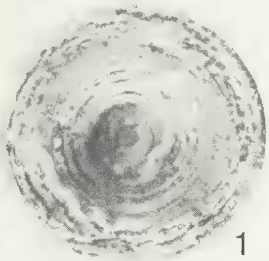
Fig. 10—*Gyrodoma etheridgei* (Cresswell), P38504, hypotype, X 4/5.

Fig. 11—*Murchisonia* (*Murchisonia*) *pritchardi* (Etheridge), F.4112b, paralectotype, X 2½.

Fig. 12—*Murchisonia* (*Murchisonia*) *pritchardi* (Etheridge), F.4112a, lectotype, X 2½.

Fig. 13—*Murchisonia* (*Murchisonia*) *pritchardi* (Etheridge), F.4112b, paralectotype, X 2½.

Fig. 14—*Murchisonia* (*Murchisonia*) *pritchardi* (Etheridge), P946, hypotype, X2.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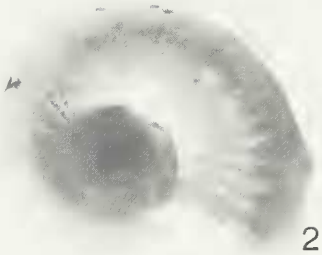
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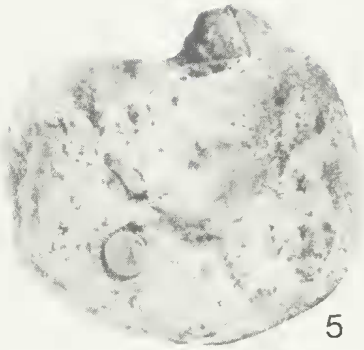
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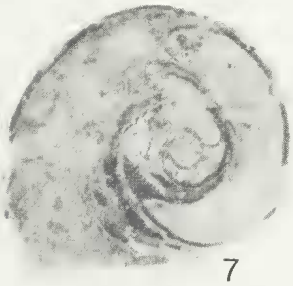
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1894 *Niso* (*Vetotuba*) *brazieri* Etheridge; Cresswell, p. 158.
1913 *Vetotuba brazieri* Etheridge; Chapman, p. 227 (in part).
1916 *Coelocaulus brazieri* (Etheridge); Chapman, p. 86, pl. 3, figs. 20-22.
1916 *Coelocaulus apicalis* Chapman, p. 87, pl. 3, figs. 23-24.
1941 *Vetotuba brazieri* Etheridge; Knight, p. 382, pl. 46, figs. 3a-c.

Diagnosis: Medium to large, narrowly umbilicate, cyrtoconoid gastropod, with pseudoselenizone.

Description: Medium to large, high spired, cyrtoconoid gastropod; numerous whorls; whorl profile gently convex to nearly flat; sutures shallow, impressed; base flatly rounded with sub-rounded periphery, narrowly umbilicate; columellar lip straight otherwise inner lip unknown; outer lip unknown except that it gives rise to a pseudoselenizone that is bordered by two ridges; sculpture known only in part; fine collabral lines present on the whorl base, umbilicus and lower region of the outer whorl surface; the collabral lines swing backwards moderately from the umbilicus and continue across the base and onto the lower area of the outer whorl surface, where they continue backwards a short distance; moderately thin shell; earlier whorls greatly thickened by internal secondary deposits.

Dimensions: All specimens are incomplete.

	Ht	Wt	Wh
F.1145	42	22	10
F.1240	55	—	—
P1057	43	23+	—
P1058	41	17	12
P12842	52	20+	—
P12843	32	19+	—
P37755	53	20	10

Location of Types: 1. *Vetotuba brazieri.* Australian Museum. Holotype, F.1145 (designated by Knight (1941, p.382)). Paratype, F. 1240a. National Museum of Victoria. Hypotypes, P1057, A. W. Cresswell Coll. P12842, J. S. Green Coll. P12843, G. B. Pritchard Coll.

2. *Coelocaulus apicalis,* National Museum of Victoria. Holotype, P1058. Paratype, P1059. A. W. Cresswell Coll.

Material: Holotype, 1 paratype, 6 hypotypes and 52 other specimens. Most of the specimens lack their apical region.

Discussion: Chapman (1916, p. 86) described the presence of a 'slit band below median line, feebly concave bounded by threads above and below'. He considered that P12843 exhibited the slit band. Re-examination of this specimen suggests that the irregular spiral grooves are the result of weathering. However, both P1060 and P37757 quite clearly possess a pseudoselenizone. This feature is only found on specimens preserved in the unweathered limestone. It is not normally found on specimens that have weathered free.

Chapman (1916, p. 87) erected a new species *C. apicalis* and distinguished it from *V. brazieri* on the basis of its smaller size, smaller spiral angle, more numerous whorls, particularly in the apical region, and more regularly cylindrical umbilicus. Variation in these characters in the material from Lilydale is insufficient to justify the erection of a new species and is no more than that expected in a single population.

Comparison was also made between *V. brazieri* and *Niso darwini* by Chapman (1916, p. 87). The form from Yass was distinguished principally by its smaller size and the more slender apical region. Etheridge also noted that *N. darwini* is smaller than the Lilydale form. Comparison of the two forms is limited by the nature of preservation of the Lilydale specimens. However, *M. brazieri* is generally of a greater size, particularly length, than the Yass form. *M. darwini* is also more slender in the apical region and has a more angular basal periphery.

M. brazieri as it is presently known differs principally from the type species in being cyrtoconoid in shape. Further comparison between the two is limited because of the relatively poor preservation of both the type species and the Lilydale species. One specimen P40619 is cryptomphalous, the umbilical region on the base being covered by a swollen callus deposit. This feature has only been observed in the one specimen.

Chapman (1907, p. 73) reported *M. brazieri* from the limestones of Marble Creek, Thomson River, Victoria. However, this specimen and material collected more recently